

REMARKS

Introduction

This application has been reviewed in light of the final Office Action mailed on April 14, 2010. Claims 21-23, 26-28, 30, 32, 34, and 42-49 are pending in this application. Claim 21, the sole independent claim, has been amended.

Applicant Request for Interview

While this Amendment After Final Rejection is believed clearly to place this application in condition for allowance, and its entry therefore believed proper under 37 C.F.R. § 1.116, if the Examiner should still believe that issues remain outstanding, the Examiner is respectfully requested to contact Applicants' undersigned attorney in an effort to resolve such issues and advance the case to issue. Thus, Applicants hereby formally request an Interview for the purpose of discussing this response with the Examiner.

The rejections under 35 U.S.C. § 103(a)

- Claims 21-23, 26, 27, 32, 42-46 and 48 were rejected under 35 U.S.C. § 103(a) as being obvious from U.S. Patent Application Publication No. 2004/0001661 A1 to Iwaki in view of the publication "Three dimensional microfabrication with two-photon-absorbed photopolymerization," by Maruo, Optics Letters, vol. 22, No. 2, Jan 1997, pp. 132-134.
- Claims 28 and 30 were rejected under 35 U.S.C. § 103(a) as being obvious from Iwaki in view of Maruo, and further in view of U. S. Patent No. 6,684,007 B2 to Yoshimura.
- Claim 34 was rejected under 35 U.S.C. § 103(a) as being obvious from Iwaki in view of Maruo, and as evidenced by U.S. Patent No. 5,255,070 to Pollak.

- Claims 47 and 49 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Iwaki in view of Maruo, and further in view of the publication "Two-photon polymerization initiators for three-dimensional optical data storage and microfabrication," by Cumpston, *Nature*, vol. 398, March 199, pp. 51-54.

Applicants submit that independent method claim 21, together with the claims dependent therefrom, are patentably distinct from the cited references for at least the following reasons.

Claim 21 as amended is directed to a method for producing a printed circuit board element. The method includes mounting at least one optoelectronic component to a substrate. The method also includes subsequently applying to the substrate an optical layer, comprised of an optical material changing its refractive index under photon irradiation, while embedding the optoelectronic component in the optical layer. The method also includes determining, by an optical vision and targeting unit, a position of the optoelectronic component embedded in the optical layer, and measuring distances on the printed circuit board element as presently formed.

The method also includes subsequently controlling, by the optical vision and targeting unit, a radiation unit including a lens system to displace a focal area of an emitted laser beam, in a plane of said printed circuit board element, and adjusting the focal area also in terms of a depth within the optical layer. The method further includes thereafter producing an optical waveguide structure adjoining the optoelectronic component within the optical layer by photon irradiation, the optical waveguide structure being surrounded by the remaining optical layer.

Accordingly, among the notable features of amended claim 21 are that the method also includes determining, by an optical vision and targeting unit, a position of the optoelectronic component embedded in the optical layer, and measuring distances on the printed circuit board element as presently formed. Support for the amendment is found in the present

application, at least at page 10, last paragraph (“In detail, this structuring of the optical layer 3 using the vision or targeting unit 16...”).¹

The newly introduced portions in claim 21 even more precisely distinguish over the combination of cited references including Maruo. As Applicants have argued before, this reference merely teaches the use of a CCD camera for taking images of structures formed by solidified resin which may be viewed on a monitor (cf. the arrangement of Fig. 2), whereas scanning the sample under computer control is done independent from the signal of the CCD-camera and the monitor.

Even assuming *arguendo* that Maruo were deemed to involve a "vision unit", i.e., a tool for observing the investigated sample, this reference does not provide for a targeting unit, which allows for identifying the position of the optoelectronic component, measuring distances on the printed circuit board element as presently formed, and then controlling, by this optical vision unit, the radiation unit to three-dimensionally adjust the focal area for precisely adjoining the waveguide to the optoelectronic component.

In the Office Action (see page 3), the Examiner argues that for the arrangement of Maruo et al. "it would have been an obvious choice for the person [of ordinary skill in the art] to implement feedback (by connecting/linking the digital output of the CCD camera with the computer...)".

The Examiner also states that the level of a person of ordinary skill in the art of optical waveguides is high. While this may in general be true, the skilled person would certainly not consider the implementation of the claimed vision and targeting unit in the system of Maruo et al., as this system does not comprise an optoelectronic component to be accurately joined

¹It is of course to be understood that the references to various portions of the present application are by way of illustration and example only, and that the claims are not limited by the details shown in the portions referred to.

with an optical layer. Accordingly, the competent person would have no incentive to provide for such a targeting unit, which, however, would be necessary for proving the alleged obviousness of the claimed subject-matter. Furthermore, the targeting and measuring of the optoelectronic component far exceeds the compensation of possible inaccuracies in placement, which the Examiner cites as an example for feedback loops.

With regard to the primary prior art reference Iwaki, Applicants submit, as discussed in previous papers, that the alleged "straight forward" modification of the fabrication sequence is based on impermissible hindsight, and may not be derived from Iwaki in an obvious manner (MPEP 2142: "...impermissible hindsight must be avoided...").

In the outstanding Office Action, the Examiner has introduced as further "pertinent" prior art Mikami et al. (U.S. Patent No. 4,666,236). This reference, however, proves that the production of waveguides with complicated three-dimensional as claimed was not obvious at all.

Mikami et al. shows an optical coupling device 1 for optically coupling a single optical fiber 31 to two optical fibers 32, 33 in a Y-arrangement. The optical fiber 31 comprises a core 31a and a clad layer 31b. The end portion of fiber 31 is positioned in an optical medium layer 11. Accordingly, the end portions of fibers 32, 33 are positioned at the opposite end of optical medium layer 11.

For forming a waveguide 20, a mask having an aperture in conformity with the shape of the optical waveguide 20 is placed over the optical medium layer 11. The layer 11 is then irradiated from above which results in the polymerization of the exposed portions of layer 11 (cf., e.g., col. 3, l. 7 - 14).

Thus, this reference merely teaches to form a waveguide by irradiation of an optical layer through a mask, which is clearly different from the invention, where a radiation unit with a lens system - *without* mask - is provided to adjust the focal area for producing an optical

waveguide structure.

The technique shown in Mikami et al. has the drawback that only simple waveguides may be formed which extend from the bottom to the top of layer 11, as can be clearly seen, e.g., from Fig. 1 of Mikami et al. On the other hand, the invention makes it possible to produce three-dimensional structures, as the focal area of the laser beam is also adjusted in terms of depth with the optical layer.

Hence, the present method is not only novel, but, moreover, is non-obvious, and, therefore, is patentable.

Conclusion

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Respectfully submitted,

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